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Task complexity and second language narrative production: Effects of individual differences in working memory, foreign language aptitude and anxiety

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Introduction

Communicating in a foreign or second language (L2) involves exchanging a wide range of communicative intentions while adapting to different situations and contexts. Second language learners' production can be regarded as the result of a number of interacting factors such as the complexity of the communicative task performed, their cognitive abilities such as aptitude for foreign languages, affective characteristics such as anxiety, their proficiency level or time constraints just to mention a few. Communicative goals can be considered to be a series of discrete tasks such as: giving instructions or narrating a story. Research into the role of tasks and task features in second language acquisition (SLA) has received considerable attention in recent years (see Gilabert, 2007; Robinson & Gilabert 2007 for a review). Researching the effects of task-related variables on language production and language learning is essential to understand how task design and task sequencing may enhance language learning and how tasks may be used and exploited effectively in task-based syllabi. For these reasons, task characteristics have been in the focus of task-based language learning and teaching (TBLT) research. Researchers have studied tasks from different perspectives including interactional (e.g., Révész, 2007) and cognitive, information-processing (e.g., Skehan, 2003; Gilabert, 2005; Robinson, 2007b). Studying the interactive and cognitive demands of communicative tasks and their effects on language production has both theoretical interest for SLA and pedagogic relevance for materials and syllabus design as it provides important insights into the processes underlying performance in an L2 while contributing to the development of a framework for pedagogic decisions about the classification and sequencing of tasks in language teaching (Robinson, 1995, 2005b).

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This dissertation aimed to explore the effects of manipulating task complexity on linguistic performance from an information-processing perspective following the line of research which investigates the interplay of cognitive task complexity and other task factors including interactive and individual learner variables (Robinson, 2005b; Robinson & Gilabert, 2007). To achieve a deeper understanding of how cognitive task complexity and individual learner variables interact in written and oral communication, this research project used language production data from the same group of higher-intermediate level learners for both written and oral narrative tasks. The study focused on various general and task-specific measures of linguistic performance regarding the fluency, lexical richness, grammatical complexity and accuracy of learner output.

Theoretical background

Three main fields of research constitute the background to this study: task-based language learning in SLA, individual differences in L2 learning and psycholinguistic accounts of L2 production with specific regard to the role of attention and memory in language production. Therefore, Chapter 2 of the dissertation begins with a presentation of research on communicative tasks and task features with an emphasis of the construct of task complexity and influential models of task complexity. Since this dissertation follows the information-processing line of research which focuses on the influence of cognitive task complexity on task performance, a key issue of discussion concerns the allocation of attentional resources during task completion.

Task complexity

The two most influential models of task complexity, Skehan's Trade-Off Hypothesis (2007, 2009) and Robinson's Cognition Hypothesis (2005b, 2007b) have motivated a great number of studies that examine the effects of manipulating the different dimensions of task complexity on L2 output, interaction, learning and learners' perception of task difficulty

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(Robinson & Gilabert 2007). Skehan's (2007, 2009) and Robinson's (2005b, 2007b) hypetheses make contrasting predictions as to the effect of increasing task complexity along various dimensions of L2 performance. Skehan's Trade-Off Hypothesis views attention and memory as limited in capacity, therefore, he suggests that increasing task complexity reduces the pool of available attention and memory resources. As a result some aspects of performance will be attended to while others will not, for example, either the accuracy or the complexity of learner output will be affected negatively. Skehan also claims that cognitively more demanding tasks draw learners' attention away from linguistic forms so that enough attention could be paid to message content.

Robinson's Cognition Hypothesis (2005b, 2007b) states that sequencing tasks from simple to complex allows students to progress towards real-world target tasks. Bringing together information-processing theories and psychological models of attention and performance (Schmidt, 2001; Wickens, 2007), the Cognition Hypothesis is based on the assumption that although attentional capacity is limited, there are multiple attentional resource pools accessible to learners while they perform a task. In line with this assumption, Robinson distinguishes between two dimensions of cognitive task complexity: resource-directing and resource-dispersing dimensions, which belong to different attentional resource pools. Robinson proposes that increasing task complexity along resource-directing dimensions (such as reasoning demands, reference to past in narratives etc) can lead to greater accuracy and grammatical complexity of L2 output as such demands can direct learners' attention to how the concepts and functions required by the task (e.g., hypothesizing, reasoning etc) have to be grammatized using specific linguistic forms (Gilabert, 2005). A point where the two models make similar suggestions concerns resource-dispersing features of task complexity (e.g.: planning time, task familiarity etc). According to Robinson's Cognition Hypothesis, increasing complexity along this dimension

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depletes learners' attention without having the beneficial effect of directing it to any specific linguistic aspect of L2 production, therefore, fluency, accuracy and complexity will decrease.

This dissertation also aimed to investigate the role of two major cognitive variables and an affective trait in L2 narrative task performance. Chapter 2 of the dissertation describing the theoretical background of the study presents the constructs of working memory capacity and foreign language aptitude because they are considered to be among the most important factors predicting L2 learning success (e.g., Miyake & Friedman, 1998), and that of foreign language anxiety as it has been proven to influence directly L2 performance at the different stages of cognitive processing (MacIntyre & Gardner, 1994).

Working memory (WM)

The most widely accepted conceptualization of short-term memory in current SLA research is the working memory model developed by Baddeley and Hitch (1974; Baddeley, 2003). The model contains a multifunctional system called the central executive which regulates the allocation of attention during processing and two slave systems: the phonological loop and the visuo-spatial sketchpad, responsible for verbal and visual-spatial information respectively. Baddeley (2003) recently added the episodic buffer to the model which integrates incoming information from the slave systems with existing information in long-term memory. In this model working memory is viewed as a dynamic construct responsible for the temporary storage and manipulation of information, hence its important role in cognitive processes (Robinson, 2003b). Consequently, the WM capacity of individual learners can be used in predicting how effectively they can perform certain complex cognitive skills such as language production or language processing. Thus researching complex WM in the context of SLA and TBLT is highly relevant for two reasons: i) working memory mediates the cognitive processes underlying language use, and ii) as such it also contributes to the immense individual variability in L2 performance outcomes (e.g., Miyake & Friedman, 1998). Also, while the verbal component of WM, the

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phonological loop has been given much attention to in SLA research in recent years (for a review see Trebits & Kormos, 2009), the effects of complex WM capacity on second language production have not yet been studied to a comparable extent. Meanwhile researching the effects of the functioning of other parts of complex WM such as the central executive which is responsible for regulating attention (Gathercole, 1999) would also be important in SLA and more specifically in TBLT research.

Foreign language aptitude

According to the definition of aptitude by Carroll (1981), it is an individual characteristic which controls the rate of progress made in L2 learning. Based on the results of their large-scale investigation, Carroll and Sapon (1959) identified four components of language aptitude: i) phonetic coding ability, ii) grammatical sensitivity, iii) rote learning ability, and iv) inductive learning ability. Although the traditional Carollian construct of language aptitude has received a lot of criticism for issues of construct validity and relevance in today's communicative language classrooms among others, this area of research is still promising since language aptitude has been the best predictor of language learning success (Sawyer & Ranta, 2001; Dörnyei, 2005).

Contemporary research suggests new conceptualizations of the term as well as new directions for future research (Skehan, 2001; Robinson, 2001a, 2005a, 2007a; Sawyer & Ranta, 2001; Abrahamsson & Hyltenstam, 2008). Robinson (2001a, 2005a) proposed a dynamic aptitude construct in which cognitive resources and abilities are combined into aptitude complexes that can be matched to instructional options such as rule explanation. Miyake & Friedman (1998) claim that working memory is the central component of language aptitude as it matches the language processing requirements of the simultaneous storing and processing of information. Skehan (2001) suggests that the various stages of SLA (e.g.: noticing, pattern recognition) could be matched to certain aptitude constructs such as phonetic coding ability and grammatical sensibility.

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In the light of recent advances in aptitude research it can be concluded that further investigating the role of traditional components of aptitude and working memory may have the potential to highlight how the interplay of learners' cognitive abilities and the manipulations of task complexity can be used to inform pedagogic decisions in task design and task sequencing.

Input/Processing/Output anxiety

Language anxiety is a widely researched affective variable within ID research (for an extensive review see Horwitz, 2010) whose particular relevance is demonstrated by its effects on several areas related to language learning: academic, cognitive, social and personal (MacIntyre, 2002). Considering the highly correlating relationship between language anxiety and L2 production, an important question researchers raised was whether poor performance was the cause or the result of high anxiety levels. An important study in this area by MacIntyre and Gardner (1994) demonstrated that raising learners' anxiety levels can lead to poor performance at three different stages of cognitive processing (input, processing and output stages) thus supporting the claim that anxiety can "play a causal role in creating individual differences in language achievement" (MacIntyre, 2002, p. 65). The differential effects of individual anxiety levels at the various stages of language production are highly relevant in a study examining the influence of the interaction of learner variables and task complexity on language production.

In an effort to bring together the issue of the effect of cognitive demands imposed on learners by tasks and the influence of IDs on L2 output, Chapter 2 ends with a description of L2 speaking and writing production theories.

L2 production

Models of L2 production regarding both speech and writing rely on psycholinguistic accounts of L1 production while trying to explain the most important differences between them (Poulisse, 1997; Kormos, 2006). Some of the most important differences between L1 and L2

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speech production include: incomplete knowledge of the L2, slower speech rate in L2, code-switching between L1 and L2 and conceptual, syntactic and phonological transfer from L1 on L2 production. To compensate for their insufficient knowledge of the language, L2 speakers often resort to different problem-solving mechanisms (e.g., Kormos, 1999). Slower speech rate in L2 is associated with a lack of automaticity in the grammatical and phonological encoding phases of speech production which means that while in L1 speakers these processes run in parallel, L2 speakers can only process their output serially, thus taking more time (Kormos, 2006). As far as L2 writing is concerned, similarly to L2 speech production, limited L2 proficiency is one major difference which results in L2 writers having to devote more memory resources to formulating or translating their message at the expense of online planning and revising (Ellis & Yuan, 2004). Another difference concerns the use of L1 in L2 writing, the L1 being drawn on by learners to assist in global planning and editing phases.

It is important to note that L1 speech and writing production models (Levelt, 1989; Kelogg, 1996) refer to similar processes such as "conceptualization" and "planning" or "formulation" and "translating" and "articulation" and "execution". Both speech and writing models recognize the importance of monitoring which may influence all the other processes (Ellis & Yuan, 2004). An important difference between the two modes of language production is that while speaking happens in real time and involves a great deal of pressure especially for lower-proficiency learners, L2 writers can usually spend more time on the monitoring and formulating processes. As a result, for example, output anxiety can be expected to affect L2 speakers to a much greater extent than L2 writers (obviously except for certain situational constraints, such as a language exam situation for instance). By examining both the spoken and written output of the same population, the present project may shed light on further details concerning the effect of time constraints and output anxiety on L2 production.

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Chapter 3 of the dissertation presents an extensive overview of the empirical studies in the field of task-based research. While research into the effects of cognitive task complexity on production is abundant (e.g., Robinson, 1995; Foster & Skehan, 1996; Skehan & Foster, 1997, 1999; Ortega, 1999; Iwashita et al., 2001; Ellis & Yuan, 2004; Gilabert, 2005, 2007; Kuiken & Vedder, 2007a, 2007b, 2008, 2009; Michel at al, 2007; Foster & Tavakoli, 2009; Gilabert et al., 2009; Révész, 2009; Robinson et al., 2009) , fewer studies have examined the effects of IDs on the performance of communicative tasks (eg., Dewaele & Furnham, 1999; Geva & Ryan, 1993; MacIntyre & Gardner, 1994; Kormos & Dörnyei, 2004; Kormos & Sáfár, 2008) and even fewer projects investigated the combined effect of cognitive complexity and individual variables (but see for example, Niwa, 2000; Robinson, 2007; Albert, 2008; Guará-Tavares, 2008; Trebits & Kormos, 2009; Révész, in press a, in press b). Furthermore, while most studies used oral tasks to elicit language data, some of them examined L2 written production (e.g., Granfeldt, 2008; Gögköz & Atay, 2009; Kuiken & Vedder, 2007b; Trebits, 2010). It is important to point out that as a result of the variety of research contexts, methods and tasks, the comparability of the findings is rather different.

Research aims and research questions

Most studies examining the subtle effects of the interaction of more than one task factor on L2 output (e.g., Kuiken & Vedder, 2007b; Trebits & Kormos, 2009) conclude that beside general measures of L2 production, task-specific measures of more aspects of performance would reveal more precise information about how tasks can direct learners' attention to certain linguistic forms and how IDs may differentiate the way in which learners can benefit from the manipulation of certain task features. This dissertation intended to fill the gap of studies on the effects of both ability and affective individual variables underlying the cognitive processes

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involved in L2 performance across modalities. In a broader sense, this study aimed to contribute to the theoretical discussion of how task complexity affects L2 performance in young adult learners by integrating language production theories, models of attention and the findings of task complexity research and to benefit language pedagogy in the area of task-based syllabus design.

In line with the above considerations, the present study was guided by the following research questions:

(1) What are the characteristics of a B2 level sample of secondary school students taking part in a bilingual educational programme with regard to complex working memory capacity, foreign language aptitude and input, processing and output anxiety?

(2) How does manipulating cognitive task complexity affect general and task-specific measures of fluency, grammatical complexity, accuracy, lexical complexity in L2 narrative production?

(3) Do the effects of cognitive task complexity on L2 narrative performance differ in oral and written production?

(4) What are the effects of individual differences in working memory capacity, foreign language aptitude and input, processing and output anxiety on L2 narrative production?

(5) Do the individual variables of working memory capacity, foreign language aptitude and input, processing and output anxiety differentiate performance to the same extent in oral and written production?

(6) Do working memory capacity, foreign language aptitude and input, processing and output anxiety differentiate task performance to the same extent in the simple and the complex narrative tasks?

Method

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The data for this research was collected in a Hungarian-English bilingual secondary school in Budapest, Hungary. The participants were students (N=44) in the second academic year of a bilingual education program which consists of a so-called zero year and four years of bilingual secondary education. At the time of the data-collection for the present research, they had just begun the second academic year of their studies and their age was between 17 and 18 years. The participants studied English in small groups and have five 45-minute English lessons per week. Their level of proficiency was rated as slightly above intermediate (corresponding to B2 in the Common European Framework of Reference (Council of Europe, 2001)) by their teachers on the basis of the language tests that they had administered to the students.

The students' phonological short-term memory capacity and complex working memory were assessed using the Hungarian version of the non-word span and backward digit span tests respectively (Racsmány et al., 2005). Their foreign language aptitude was measured using the Standard Hungarian Language Aptitude Test (HUNLAT, Ottó, 2002) consisting of four subtests, all of which are modified versions of specific tasks of the Modern Language Aptitude Test (Carroll & Sapon, 1959) and the Pimsleur Language Aptitude Battery (Pimsleur, 1966). The participants' input, processing and output anxiety was assessed using the Hungarian version of the questionnaire developed by MacIntyre and Gardner (1994). There are altogether 18 items on the questionnaire, 6 items to assess each of the three potential sources of anxiety about hearing, processing or producing English.

Two oral and two written narrative tasks were completed by the participants. The first narrative task type involved the description of a comic strip consisting of six pictures, which had to be included in the story. The pictures were presented in the correct order and the story line was given**.** The task did not require extensive planning in terms of content on the part of the students. Therefore, this task was considered to place relatively low cognitive load on the participants

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insofar as the conceptualization of their message was concerned. It did, however, tax their cognitive resources as regards linguistic formulation.

The second task type required students to describe a story based on six unrelated pictures, which all had to be included in the narrative. In order to successfully complete this task, the participants not only had to rely on their language skills, but they also had to use their imagination and find a way to relate the pictures to one another and invent a story around them. Thus, the second task imposed heavier conceptualization demands on the learners in addition to the relevant linguistic formulation demands.

The transcripts of the participants' oral and written output were used to analyze four aspects of performance on the two types of narrative tasks: accuracy, syntactic complexity, lexical diversity and fluency. Besides traditionally used measures of language production, this study employed task-relevant indices of performance selected on the basis of initial data analysis, the consultation of native speaker baseline data, and theoretical considerations (Dasinger & Taupin, 1994). Table 1 summarizes the performance measures used in this study.

Table 1. Measures of accuracy, complexity and fluency used in the present study

	Accuracy	**Lexical variety**	**Syntactic complexity**	**Fluency**
General	Ratio of error-free clauses	D value	Clause length Subordination ratio	Speech rate
Task-specific	Ratio of error-free relative clauses Ratio of error-free past tense verbs	----	Relative clause ratio	----

The data obtained after the analysis of learners' performance was analyzed using SPSS 13.0 (Statistical Package for Social Sciences). The level of significance for this study was set at $\alpha = 0.05$. Descriptive statistics providing information about means and standard deviations were

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produced in order to characterize the data collected from the participants. Paired samples t-tests and repeated measures analyses of variance (ANOVA) were used to compare learners' performance on the two types of narrative tasks and across modalities. Correlations were calculated in order to examine the relationship between ID factors (working memory capacity, foreign language aptitude and input, processing and output anxiety) and the various task performance measures used in this study.

Results and discussion

The main findings of the research reported in this dissertation are presented in Chapters 5 to 7 with a view to providing answers to the research questions that motivated it. The first research question addressed the characteristics of the sample, that is a group of upper-intermediate (B2 level, Council of Europe, 2001) secondary school students taking part in a bilingual (English-Hungarian) educational program in Budapest. Based on the results of the tests used to assess complex working memory capacity (WMC) and phonological short-term memory capacity (PSTMC), it appears that the participants form a heterogeneous group. The distributional frequency data show that their PSTMC is well above the national Hungarian average for their age group (Racsmány et al., 2005), and that more than 80% of the participants scored in the average or above average range. In contrast, complex WMC scores fall within middle or lower score range, but national average scores for this test are not available. A possible explanation for these results may lie with the fact that the complex working memory test is considerably more difficult than that of phonological short-term memory. While the non-word span test which was used to measure PSTM involves the repetition of a sequence of syllables that they heard, the backward digit span test (a complex working memory test) requires the simultaneous storage, recall and computation of the digits heard. Alternatively, we may also argue that secondary school students are often required to memorize a wide range of data sets in

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most school subjects in the Hungarian educational system (e.g., learning definitions, memorizing figures and formulas), consequently, their PSTM skills probably develop more than does their complex WMC. Also, the bilingual educational program that these students took part in is comprised of a preparatory year of intensive language learning during which students language skills were brought into line with the requirements of the bilingual program that ensues in subsequent years. Intensive language learning also develops PSTM capacity to a considerable extent, which can explain why these students achieved higher than average scores on the non-word span test measuring their PSTM capacity.

As regards foreign language aptitude, the participants of this study appear to form a homogeneous group. Their average scores on the HUNLAT aptitude test were close to the national average of university students (Ottó & Nikolov, 2003). Based on their performance on the different subtests measuring foreign language aptitude component abilities, it can be seen that rote learning ability and deductive ability emerge as the most developed in this group of students. As argued in Chapter 5, this result can be explained by the predominantly communicative methodology used to teach these students during the preparatory year. Communicative language teaching focuses primarily on lexical and communicative skills development which involves a considerable amount of rote learning (memorizing vocabulary items, collocations and colligations). Instead of explicit grammar instruction, the communicative approach favours the improvement of deductive abilities by providing opportunities for students to infer grammar rules on the basis of the grammatical expressions or colligations that they learn.

One area of potentially highly relevant individual variable was explored in the present study, namely, the role of input, processing and output anxiety (IPOA) in L2 task performance. The results of the IPOA test scale demonstrate that the participants' anxiety relative to linguistic output was considerably higher than anxiety invoked by the input and processing stages of language production. A possible explanation may be that although these students used English as

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a language of communication in some of their classes in addition to their regular English as a foreign language classes (for example: mathematics, physics and geography), they live in a monolingual society where they have few opportunities and little need to produce English both orally and in writing. In addition, the task types used in this study were designed to elicit L2 output; therefore, it is not surprising that output anxiety had the strongest effect on their performance.

Research question 2 addressed the effects of cognitive task complexity on L2 narrative performance. The findings relative to this question were interpreted on the basis of the two most influential and competing models of task complexity: Skehan's Trade-Off Hypothesis (1998; 2007; Skehan & Foster, 2001) and Robinson's Cognition Hypothesis (2001b, 2005b, 2007b). Of the two task types used in this study, the story narration task was considered to be cognitively more complex in terms of conceptualization as it required the planning of the plot of a story based on an unrelated set of pictures in addition to the linguistic formulation thereof. According to Robinson's Triadic Componential Framework (2001b, 2005b) for task classification, this complexity variable makes the task more complex along resource-dispersing dimensions. Therefore, both Robinson's (2005b) and Skehan's model (2007) predict that performance on the story narration task would be less fluent, less accurate and less complex than the quality of performance on the cartoon description task, which involved the description of a chronologically sequenced set of pictures. These predictions were partly confirmed by the results. It was found, for example, that the story narration task elicited less lexical variety in speaking and less accurate output in writing. In contrast, and running counter to my initial expectations, participants produced more structurally complex stories both in speech and in writing on the story narration task, while fluency only appeared to be effected slightly by task complexity. In order to account for these mixed results, the psycholinguistic characteristics of both task types were examined (see Table 2).

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Table 2. Overview of the psycholinguistic characteristics of the tasks with relation to the major findings of this study

	Writing		Speech	
	Cartoon description	Picture narration	Cartoon description	Picture narration
Conceptualization load (conceptualization phase)	low	high	low	high
Linguistic encoding demands (formulation phase)	high	adjustable	high	adjustable
Need to share attention between lexical and syntactic encoding	reduced	reduced	high	high

As can be seen, the narrative tasks used in this study appear to affect the conceptualization and formulation stages of language production independently of each other in addition to making cognitive demands on linguistic formulation *through* conceptualization. For example, the cartoon description task imposed low conceptualization demands on participants because it was a more structured task with picture prompts showing a clear sequence of events from beginning to end. Tight task structure had previously been associated with less processing burden while telling the story (Skehan & Foster, 1999; Tavakoli & Foster, 2008). Nevertheless, this task type can be particularly taxing as regards linguistic encoding because it pushes learners to retrieve rarely used vocabulary items from memory. The story narration task, on the other hand, directed learners' attention to using certain linguistic structures (e.g., relative clauses) in order to identify the characters and mark changes of location in their stories. Therefore, in the case of the story narration task, the cognitive load on linguistic formulation derives from higher conceptualization demands. Taken together, the results suggest that in order to account for the impact of cognitive task complexity on L2 narrative performance, existing task taxonomies would need to be extended by linking the cognitive demands of tasks to language production stages in both speech and writing.

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The third research question was concerned with the effect of task complexity in oral and written modes of performance. The results suggest that the impact of cognitive complexity was more apparent in speaking with regard to lexical diversity, and more important in writing with regard to accuracy. In both modalities the story narration task resulted in less accurate L2 production than the cartoon description task. It appears that the tasks which imposed higher conceptualization demands on learners did not generate more accurate language in my sample of students, most probably, because those tasks engaged them in planning the content of their stories and did not enable sufficient attentional resources to accuracy of production. The present findings also demonstrate that modality of performance has an important impact on linguistic output and that it explains within-participant variation in performance to a greater extent than the cognitive demands of tasks.

The fourth research question addressed the effects of individual differences in working memory, foreign language aptitude and anxiety on L2 narrative production. The findings show that students with higher complex working memory capacity do not necessarily perform better in terms of fluency, accuracy and complexity. Indeed, those students seemed to perform better on the narrative tasks whose complex working memory capacity was considered average based on their backward digit span test scores. Greater phonological short-term memory capacity, however, appears to increase the level of structural complexity of the narratives produced. With regard to another cognitive ability factor, foreign language aptitude, the results of this study suggest that of the four components of the Hungarian Language Aptitude Test, grammatical sensitivity may be regarded as having the strongest modulating effect on narrative task performance followed by deductive ability and rote learning ability. An equally interesting finding regarding the role of aptitude is that higher levels of cognitive abilities (e.g., grammatical sensitivity, deductive ability) may put learners at a disadvantage in terms of certain aspects of their performance (e.g., lexical diversity). This is in line with Robinson's Aptitude Complexes

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Hypothesis (2001a) according to which aptitude complexes of cognitive abilities influence task performance differently under varying processing conditions. As for foreign language anxiety linked to the stages of language processing (input, processing and output anxiety), the results of this study have shown that while output anxiety only had a debilitating (negative) effect on L2 production in the participants of this study, input and processing anxiety had a significant facilitating effect on some aspects of performance, namely lexical and structural complexity. It is also important to point out the importance of using task-relevant measures as well as general performance indicators in the study. Almost half of the significant relationships detected between ID variables, task complexity and performance modality would have been undetected if the study had not explicitly focused on linguistic measures that reflected the demands of the task.

The fifth research question asked whether the ID variables examined in this study differentiated narrative task performance to the same extent in oral and written modes. Of the cognitive ability variables, foreign language aptitude (FLA) components appear to be related considerably differently to measures of linguistic performance in oral and written tasks. FLA seems to have had a much more marked influence on participants' spoken production than on their written L2 output. It was also found that the grammatical sensitivity component of the HUNLAT test has a much stronger effect on performance in speaking than in writing. Interestingly, phonological sensitivity influenced students L2 production in writing considerably more than in speaking. Regarding anxiety (IPOA) effects, the results have shown an important difference between spoken and written modalities, namely that output anxiety impairs L2 performance to a considerably greater extent in speaking than in writing. In writing, however, input anxiety has an influence on several aspects of participants' performance.

The sixth research question investigated the extent to which the ID variables examined in this study differentiate the effects of task complexity on the quality of L2 output. According to the predictions of the Cognition Hypothesis (Robinson, 2005b, 2007b), learner variables would

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modulate the relationship between task complexity and L2 narrative performance to a greater extent on cognitively more complex than on simple tasks. If we examine the psycholinguistic characteristics of the tasks used in this study in terms of the cognitive processing load they involve, we may observe that ID effects seem to be more apparent in the tasks involving a higher cognitive burden in terms of linguistic formulation demands than in tasks where conceptualization demands are high. To account for these findings, it was suggested that the story narration task, which required that learners conceptualize the content of their narrative in addition to formulating it, also gave learners the opportunity to tailor their message to their linguistic means. Being upper-intermediate (B2) level students, this did not have a particularly taxing effect on their linguistic processing, unlike higher formulation demands, which pushed them to use particular words and language structures.

Conclusion

In sum, the findings emerging from this research demonstrate that task-relevant measures of performance reflect more accurately the individual and combined effects of task type, cognitive task complexity and learner variables on linguistic output. The study also found that the effect of complex working memory capacity on students' narrative performance was limited to lexical diversity and syntactic complexity. The effect of phonological short-term memory was imminent on subordination complexity and the accuracy of participants' performance. The findings also indicate a complex interaction between the components of foreign language aptitude and task performance. Deductive ability and grammatical sensitivity seemed to be most strongly related to the accuracy and complexity of production. This study has shown that spoken and written modes of task performance are influenced differently by anxiety experienced at the input, processing and output stages of L2 production.

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With regard to the effect of task complexity on participants' narrative production, the findings of this research suggest that the various stages of language production need to be taken into account when categorizing tasks on the basis of the cognitive load they impose on learners. Current taxonomies and models of cognitive task complexity would need to be complemented if we attempt to contribute to the development of task- and research-based syllabus design.

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